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Hanmin Cai is currently a PhD student at DTU. He is working on demand side management to assist heat and electric network operation, and is involved in Nordhavn project.

An Experimental Setup for Investigating Flexibility of District Heating with Fuel Shift

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Low Temperature District Heating (LTDH) has been investigated as a way of heat loss reduction and facilitating renewable energy integration. The technology is promising for space heating in well-insulated buildings, for example, those constructed in Nordhavn. However, LTDH alone is not sufficient for domestic water heating, which requires 50 °C for circulation and 60 °C as set point temperature for the storage tank due to hygiene concern. One solution is using electric heater at the house substation to increase tank water temperature. This setup also gives additional controllability for end users. Centre for Electric Power and Energy (CEE) at DTU has built a flexible heat system (FlexHeatSystem illustrated in Fig. 1) at DTU Risø Campus as combined heat and electricity research facility, which is also integrated into SYSLAB as part of the platform for Decentralized Energy Resources research.

This experimental setup consists of three parts. District heating heat source is emulated by using a 22.5kW electric heater in Fig 2, which can supply hot water up to 85 °C. With the possibility of varying the supply water temperature, this heat source can be used to study both low and high temperature district heating scenarios. Electric heater in Fig. 3 is installed at the house substation inside a residential building, to boost the tank water to be over 55 °C when LTDH is assumed. Dump load installed next to the house substation as shown in Fig. 4 is used to simulate water draw scenarios and test whether water temperature at the tapping point can comply with national codes. Flow rate and temperature sensors are installed at selected points to measure energy flow and support controller design and verification. We will study fuel-shift solution using this experimental setup. Research will firstly focus additional flexibility that local electrified heating alternatives can offer to the DH system while guarantee user comfort. Furthermore we will study its potential for providing ancillary services to power system. We will conclude with the research with fuel-shift feasibility and implications for industrial application.

